Massachusetts
Department
Of
Public Health

Evaluation of Cancer Incidence in Census Tracts 3746 and 3747 in Newton and Census Tract 3686 in Waltham, Massachusetts

2000-2004

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Bureau of
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TABLE OF CONTENTS

List of Figures

List of Tables

Appendices

I. INTRODUCTION

In response to a request from the Newton Health Department, the Community Assessment Program (CAP) of the Massachusetts Department of Public Health, Bureau of Environmental Health (MDPH, BEH) has evaluated cancer incidence data for the five-year period 2000 to 2004 for census tracts (CTs) 3746 and 3747 in Newton and census tract 3686 in Waltham (see Figure 1).

Several years ago, a student from the Tufts University School of Medicine evaluated the incidence of 11 cancer types in these three census tracts in the cities of Newton and Waltham, MA for the period 1982-1990. The evaluation was prompted by concerns from residents of the Auburndale section of Newton that a possible elevation in cancer incidence existed in the area surrounding the former Pine Street Landfill located in Newton CT 3747. The report concluded that no statistically significant elevations in the 11 cancer types were found in any of the three census tracts evaluated (CT 3836, CT 3746, and CT 3747). A recommendation was made that the information be re-evaluated once additional years of cancer incidence data became available (Yasumoto 1994). Subsequently, the Newton Health Department submitted a written request to the MDPH for review of more recent cancer incidence data for the two communities.

This evaluation provides an update of the incidence of the same 11 cancer types in CTs 3746 and 3747 in Newton and CT 3686 in Waltham for the years 2000 through 2004, and compares the incidence of these cancers with the cancer experience of the state of

Massachusetts. Cancer incidence data for Newton and Waltham were obtained from the Massachusetts Cancer Registry (MCR). The 11 cancer types include leukemia and non-Hodgkin's lymphoma as well as cancers of the bladder, brain and central nervous system (CNS), breast, lung and bronchus, kidney and renal pelvis, liver and intrahepatic bile duct (IBD), pancreas, stomach and thyroid.

In addition to calculating small-area cancer incidence rates, a qualitative analysis of the geographic distribution of individuals diagnosed with each of the 11 types of cancer was conducted by mapping their residence at the time of diagnosis. This was done to determine whether the geographic pattern of cancer types in these census tracts was unusual.

II. METHODS

A. **Case Identification/Definition**

Cancer incidence data (i.e., reports of new cancer diagnoses) for Newton CTs 3746 and 3747 and Waltham CT 3686 for the years 2000-2004 were obtained from the MCR, a division of the MDPH Bureau of Health Information, Statistics, Research and Evaluation (BHISRE). The MCR is a population-based surveillance system that began collecting information in 1982 on Massachusetts residents diagnosed with cancer in the state. All newly diagnosed cancer cases among Massachusetts residents are required by law to be reported to the MCR within 6 months of the date of diagnosis (M.G.L. c.111 s.111B).

Eleven cancer types were evaluated in this investigation, including cancers of the bladder, brain and central nervous system (CNS), breast, kidney and renal pelvis, liver and intrahepatic bile duct (IBD), lung and bronchus, pancreas, stomach, and thyroid as well as leukemia and non-Hodgkin's lymphoma. [Coding for cancer types in this report follows the International Classification of Diseases for Oncology (ICD-O) system.] All diagnoses reported to the MCR as primary site cancers among residents of the three CTs for the eleven cancer types were included in the analysis. Individuals diagnosed with cancer were included in this investigation based on the address reported to the hospital or reporting medical facility at the time of diagnosis.

The term "cancer" is used to describe a variety of diseases associated with abnormal cell and tissue growth. Epidemiologic studies have revealed that different types of cancer are individual diseases with separate causes, risk factors, characteristics and patterns of survival (Berg 1996). Cancers are classified by the location in the body where the disease originates (the primary site) and the tissue or cell type of the cancer (histology). Therefore, each of the cancer types reviewed in this report was evaluated separately. Cancers that occur as the result of the metastasis or the spread of a primary site cancer to another location in the body are not considered as separate cancers and therefore were not included in this analysis.

It should be noted that duplicate records were eliminated from the analysis in this report. Duplicate cases are reports of the same primary site cancer diagnosed in an individual submitted to the MCR by another health-care provider. The decision that a case was a duplicate and therefore excluded from the analyses was made by the MCR after consulting with the reporting hospital/diagnostic facility and obtaining additional

information regarding the histology and/or pathology of the case. However, reports of individuals with multiple primary site cancers were included as separate cases in this report. In general, a diagnosis of a multiple primary cancer is defined by the MCR as a new cancer in a different location in the body or a new cancer of the same histology (cell type) as an earlier cancer, if diagnosed in the same primary site (original location in the body) more than 2 months after the initial diagnosis (MCR 2003).

B. **Calculation of Standardized Incidence Ratios (SIRs)**

To determine whether an elevation occurred among individuals diagnosed with cancer in CTs 3746, 3747, or 3686, cancer incidence data were tabulated by gender according to eighteen age groups to compare the observed number of cancer diagnoses to the number that would be expected based on the statewide cancer rate. Standardized incidence ratios (SIRs) were then calculated for the time period 2000-2004 for each of the eleven primary cancer types for each CT.

To calculate SIRs, it is necessary to obtain accurate population information. The population figures used in this analysis were based on 2000 U.S. census data (U.S. DOC 2000a) and population projections for 2010. Midpoint population estimates were calculated for the time period evaluated. To estimate the population between census years, an assumption is made that the change in population occurs at a constant rate throughout the ten-year interval between each census.[1]

A CT is a geographic subdivision of a city or town designated by the United States

[1] Using slightly different population estimates or statistical methodologies, such as grouping ages differently or rounding off numbers at different points during calculations, may produce results slightly different from those published in this report.

Census Bureau. Because age group and gender-specific population information is necessary to calculate incidence rates, the CT is the smallest geographic area for which cancer rates can be accurately calculated. Specifically, a CT is a smaller statistical subdivision of a county as defined by the U.S. Census Bureau. CTs usually contain between 1,500 and 8,000 persons and are designed to be homogenous with respect to population characteristics (U.S. DOC 2000b).

Census tract SIRs were not calculated for some cancer types due to the small number of observed cases (less than five). It is standard BHISRE policy not to calculate rates with fewer than five observed diagnoses. However, the expected number of diagnoses was calculated for each CT, and the observed and expected numbers of diagnoses were compared to determine whether excess numbers of cancer diagnoses were occurring.

C. **Interpretation of a Standardized Incidence Ratio (SIR)**

An SIR is an estimate of the occurrence of cancer in a population relative to what might be expected if the population had the same cancer experience as a larger comparison population designated as "normal" or average. Usually, the state as a whole is selected to be the comparison population. Using the state of Massachusetts as a comparison population provides a stable population base for the calculation of incidence rates.

Specifically, an SIR is the ratio of the observed number of cancer diagnoses in an area to the expected number of diagnoses multiplied by 100. The age-specific statewide incidence rates are applied to the population structure of each CT to calculate the number of expected cancer diagnoses. The SIR is a comparison of the number of cases in the specific area (i.e., city/town or census tract) to the statewide rate. Comparison of SIRs

between communities or census tracts is not possible because each community/CT has different population characteristics.

An SIR of 100 indicates that the number of cancer diagnoses observed in the population being evaluated is equal to the number of cancer diagnoses expected in the comparison or "normal" population. An SIR greater than 100 indicates that more cancer diagnoses occurred than were expected, and an SIR less than 100 indicates that fewer cancer diagnoses occurred than were expected. Accordingly, an SIR of 150 is interpreted as 50% more cancer diagnoses than the expected number; an SIR of 90 indicates 10% fewer cancer diagnoses than expected.

Caution should be exercised, however, when interpreting an SIR. The interpretation of an SIR depends on both the size and the stability of the SIR. Two SIRs can have the same size but not the same stability. For example, an SIR of 150 based on four expected cases and six observed diagnoses indicates a 50% excess in cancer, but the excess is actually only two diagnoses. Conversely, an SIR of 150 based on 400 expected diagnoses and 600 observed diagnoses represents the same 50% excess in cancer, but because the SIR is based upon a greater number of diagnoses, the estimate is more stable. It is very unlikely that 200 excess diagnoses of cancer would occur by chance alone. As a result of the instability of incidence rates based on small numbers of diagnoses, SIRs were not calculated when fewer than five diagnoses were observed for a particular cancer type.

D. **Calculation of the 95% Confidence Interval**

To help interpret or measure the stability of an SIR, the statistical significance of each SIR was assessed by calculating a 95% confidence interval (95% CI) to determine if the observed number of diagnoses is “significantly different” from the expected number or if the difference may be due solely to chance (Rothman and Boice 1982). Specifically, a 95% CI is the range of estimated SIR values that have a 95% probability of including the true SIR for the population. If the 95% CI range does not include the value 100, then the study population is significantly different from the comparison or "normal" population. "Significantly different" means there is less than a 5% chance that the observed difference (either increase or decrease) is the result of random fluctuation in the number of observed cancer diagnoses.

For example, if a confidence interval does not include 100 and the interval is above 100 (e.g., 105–130), there is a statistically significant excess in the number of cancer diagnoses. Similarly, if the confidence interval does not include 100 and the interval is below 100 (e.g., 45–96), the number of cancer diagnoses is statistically significantly lower than expected. If the confidence interval range includes 100, the true SIR may be 100. In this case, it cannot be determined with certainty that the difference between the observed and expected number of diagnoses reflects a real cancer increase or decrease or is the result of chance. It is important to note that statistical significance does not necessarily imply public health significance. Determination of statistical significance is just one tool used to interpret SIRs.

In addition to the range of the estimates contained in the confidence interval, the width of the confidence interval also reflects the stability of the SIR estimate. For example, a

narrow confidence interval, such as 103–115, allows a fair level of certainty that the calculated SIR is close to the true SIR for the population. A wide interval, for example 85–450, leaves considerable doubt about the true SIR, which could be much lower or much higher than the calculated SIR. This would indicate an unstable statistic. Again, due to the instability of incidence rates based on small numbers of diagnoses, statistical significance was not assessed when fewer than five diagnoses were observed.

E. **Determination of Geographic Distribution of Cancer Diagnoses**

In addition to calculating SIRs, the address at the time of diagnosis for each individual diagnosed with one of the 11 cancer types in CTs 3746, 3747, and 3686 was mapped using a computerized geographic information system (GIS) (ESRI 2006). This allowed assignment of CT location for each individual diagnosed with cancer as well as an evaluation of the spatial distribution of the individuals' residences at a smaller geographic level within CTs (i.e., neighborhoods). The geographic pattern was determined using a qualitative evaluation of the point pattern of cancer diagnoses in the three CTs. This evaluation included consideration of the population density variability of each CT through the use of GIS-generated population density overlays. In instances where the address information from the MCR was incomplete, that is, did not include specific streets or street numbers, efforts were made to research those individuals diagnosed with cancer (e.g., by using telephone books issued within 2 years of an individual's diagnosis or searching files via the Registry of Motor Vehicles). For confidentiality reasons, it is not possible to include maps showing the locations of individuals diagnosed with cancer in this report. [Note: MDPH is bound by state and federal patient privacy and research laws not to reveal the name or any other identifying information of an individual

diagnosed with cancer and reported to the MCR.] However, a summary of this evaluation with any notable findings is presented in this report.

III. RESULTS OF CANCER INCIDENCE ANALYSIS

The section presents a summary of cancer incidence rates for the three CTs during the 5-year time period 2000-2004. Tables 1-3 contain cancer incidence data for the three CTs. SIRs were not calculated for some cancer types due to the small number of observed diagnoses (less than five). As previously mentioned, the expected number of diagnoses was calculated and the observed and expected numbers of diagnoses were compared to determine whether an elevation in cancer incidence exists based on the statewide experience.

A. Newton CT 3746

During 2000-2004, cancer incidence rates in CT 3746 were about as expected or less than expected for all 11 cancer types (see Table 1).

B. Newton CT 3747

With the exception of breast cancer, cancer incidence rates in CT 3747 were about as expected for the cancer types evaluated (see Table 2). Breast cancer incidence was statistically significantly elevated in CT 3747 from 2000-2004. During this time, there were 31 diagnoses when approximately 18 would have been expected (SIR = 170; 95% CI: 116 - 242).

A detailed summary of the known and possible risk factors for breast cancer is included as Appendix A. Known risk factors that increase a woman's risk of developing breast cancer include the following: a family history of breast cancer; certain genetic mutations; pre-existing medical conditions such as benign breast conditions, radiation therapy to the chest for a previous cancer, and a history of ovarian cancer; reproductive factors including early age at menstruation, late age at menopause, late age at first full-term pregnancy, and hormone replacement therapy; and, lifestyle factors such as lack of physical activity, regular alcohol consumption, and obesity. Cumulative exposure of the breast tissue to estrogen and progesterone hormones may be one of the greatest contributors to an increased risk of breast cancer. To date, no specific environmental factors have been conclusively linked to an increased risk of breast cancer. However, studies are still being conducted to more thoroughly evaluate possible associations between exposure to environmental contaminants and an increased risk of breast cancer.

Risk factor information available from the MCR was reviewed for women diagnosed with breast cancer in this CT. It should be noted that information on many of the risk factors identified above is not reported to the MCR. From the epidemiological literature, it is known that a woman's risk of developing breast cancer increases with age. According to the American Cancer Society (ACS), the chance of an American woman developing invasive breast cancer at some time in her life is about 1 in 8 (12%). The ACS also reports that about 2 out of 3 (67%) women with invasive breast cancer are age 55 or older when they are diagnosed while about 1 in 8 (13%) invasive breast cancer diagnoses are among women younger than age 45 (ACS 2008a). In Newton CT 3747,

10% of the women diagnosed with breast cancer between 2000 and 2004 were under the age of 45 at diagnosis, compared to 13% nationally. Fifty-two percent of the women in CT 3747 were age 55 or older at diagnosis compared to 66% nationally. In Massachusetts, during 2000-2004, the average age of women diagnosed with breast cancer was 62 years. The average age at the time of diagnosis for women residing in CT 3747 was 57 years. It appears that women residing in CT 3747 are being diagnosed less often under the age of 45, more often between the ages of 45 and 55, and less often over age 55 than would be expected. Given the relatively small number of diagnoses in CT 3747 (n = 31), compared to the U.S. or Massachusetts as a whole, some variability in the age distribution would be expected.

MDPH reviewed cancer staging information for women diagnosed with breast cancer in Newton CT 3747 for the period 2000-2004. Staging describes the extent of spread of an individual's cancer; from a public health perspective, earlier breast cancer staging reflects to some extent whether women are being screened early and regularly for breast cancer. In CT 3747, approximately 55% of the women diagnosed with breast cancer between 2000 and 2004 were diagnosed with localized breast cancer compared to 65% in Newton as a whole and statewide. A localized breast cancer is contained within the tissue of origin, or primary site. In CT 3747, approximately 39% of the female breast cancer diagnoses were diagnosed with regional breast cancer compared to 30% in Newton as a whole and 27% statewide. A regional cancer has spread to the lymphatic system, and tumor cells can be detected in one or more lymph nodes. Although the percent of women in Newton CT 3747 whose breast cancers were detected as local or regional stage cancers

differed from those of Newton as a whole or statewide, these differences in percentages were not statistically significant.

According to the American Cancer Society and the medical literature, women who have had no children or who had their first child after age 30 have a slightly higher risk of breast cancer. MDPH reviewed data on maternal age at first birth, available through the Massachusetts Community Health Profile (MassCHIP), for Newton as a whole. (Census-tract level data are not available through MassCHIP.) For the year 2000, 71% of the women in Newton had their first child at age 30 or older compared to 43% statewide. It is possible that a higher percentage of women in CT 3747, like women in Newton as a whole, had their first child after age 30 and that this may be contributing to the elevation in breast cancer incidence.

The ACS also reports that women, who as children or young adults, had radiation therapy to the chest as treatment for another cancer (such as Hodgkin lymphoma or NHL) are at significantly higher risk for breast cancer. Review of MCR data showed that 3 of the 31 (10%) women diagnosed with breast cancer during 2000-2004 had been previously diagnosed with cancer. While it is unknown whether radiation was used for treatment of their previous cancers, it is possible that such treatment may have contributed to some breast cancer diagnoses.

Overall, there did not appear to be any unusual geographic patterns among diagnoses. Although several women diagnosed in CT 3747 lived in close proximity to each other, when their dates of diagnosis, ages at diagnosis, and population density patterns were considered, the patterns did not seem unusual.

C. Waltham CT 3686

During 2000-2004, cancer incidence rates in CT 3686 were about as expected or less than expected for all 11 cancer types (see Table 3).

IV. DISCUSSION

According to the American Cancer Society, cancer is the second leading cause of death in Massachusetts and the United States (ACS 2008b). Not only will one out of three women and one out of two men develop cancer in their lifetime, but cancer will affect three out of every four families. A suspected "cluster" of cancer diagnoses is more likely to be a true cancer cluster if it involves a large number of cases of one type of cancer diagnosed in a relatively short time period rather than several different types diagnosed over a long period of time (i.e., 20 years), a rare type of cancer rather than common types, and/or a large number of cases diagnosed among individuals in age groups not usually affected by that cancer. These types of clusters may warrant further public health investigation.

Descriptive epidemiological analyses such as this can be useful in evaluating cancer patterns in a geographic context, assessing if a common cause or etiology is possible, and serving to identify areas where further public health investigations or actions may be warranted. This descriptive analysis of cancer incidence data alone cannot be used to establish a causal link between a particular risk factor (either environmental or non-environmental) and the development of cancer. In addition, this analysis cannot determine the cause of any one individual's cancer diagnosis. The purpose of this

evaluation was to provide an update on the incidence of 11 types of cancer in three census tracts, two in Newton and one in Waltham, which were the focus of an earlier report prepared for the City of Newton (Yasumoto E 1994).

Except for breast cancer in Newton CT 3747, the incidence of the 11 types of cancer that were the focus of this evaluation was about as expected in the three census tracts for the five-year period examined (2000-2004). The incidence of breast cancer was statistically significantly elevated among females in Newton CT 3747 with 31 diagnoses reported when approximately 18 would have been expected.

In January 1997, MDPH's BEH released a report on breast cancer incidence in Newton for the years 1982-1992 (MDPH 1997). The findings showed that the overall rate of breast cancer in Newton was significantly greater than expected. Upon further analysis, there appeared to be considerable geographic variation in the occurrence of breast cancer across the 18 Newton census tracts. During the 1982-1992 time period, the incidence of breast cancer in CT 3747 was lower than expected but the finding was not statistically significant. In a follow-up study funded through MDPH's breast cancer research initiative (Silent Spring Institute (SSI) et al. 1999), researchers looked to see if certain factors were associated with living in areas of Newton with higher breast cancer incidence. SSI researchers found that higher socioeconomic status and more intensive breast cancer screening patterns likely played some role in the higher incidence areas; they also found that the use of some pest control products, spermicide, and professional

dry cleaning was also more likely to have been used by women in the high-incidence areas.

In the late 1990s, with the release of both the MDPH report on breast cancer incidence in Newton and the follow-up study conducted by SSI, public awareness in Newton of the importance of early screening for breast cancer increased. While the incidence of breast cancer was lower than expected in CT 3747 during the period previously studied by MDPH and SSI, it may be that an increase in screening followed the increase in publicity, which in turn resulted in the higher incidence of breast cancer seen in this CT in the subsequent years. There were somewhat more diagnoses of breast cancer in the first two years (2000 and 2001) following the report releases compared to the following three years (2002 through 2004).

According to the American Cancer Society, breast cancer incidence in the United States differs with socioeconomic status (SES). Lifetime risk of breast cancer is higher in women of higher SES. It is likely that SES is not in itself the associated risk factor for breast cancer. Rather, SES probably represents different patterns of reproductive choices (e.g. not having children or having children later in life), occupational backgrounds, environmental exposures, and lifestyle factors (i.e., diet, physical activity, cultural practices). According to the 2000 U.S. Census, approximately 65% of Newton women age 25 or older have at least a Bachelor's or graduate-level degree compared to 31% statewide. In Newton CT 3747, 57% of women age 25 or older have at least a Bachelor's degree. In addition, according to the 2000 U.S. Census, the median income for all

Newton households was $86, 052 compared to a statewide median income of $50,502. In CT 3747, the median household income was $78,566. The higher than expected breast cancer incidence in Newton and in CT 3747 appears to be in part correlated with educational level and median income (two measures of socioeconomic status).

V. CONCLUSIONS AND RECOMMENDATIONS

For the most part, a review of cancer incidence data for the five-year period 2000-2004 did not reveal any unusual patterns in the two census tract of Newton, CTs 3746 and 3747, or in CT 3686 in Waltham for the 11 cancer types evaluated. The incidence of breast cancer was, however, statistically significantly elevated in one of the two Newton CTs, CT 3747. As discussed, a variety of factors may have contributed to this elevation, including higher screening rates in the years immediately following substantial public awareness about breast cancer in Newton. The MDPH/BEH will continue to monitor the incidence of cancer in Newton and Waltham through the Massachusetts Cancer Registry.

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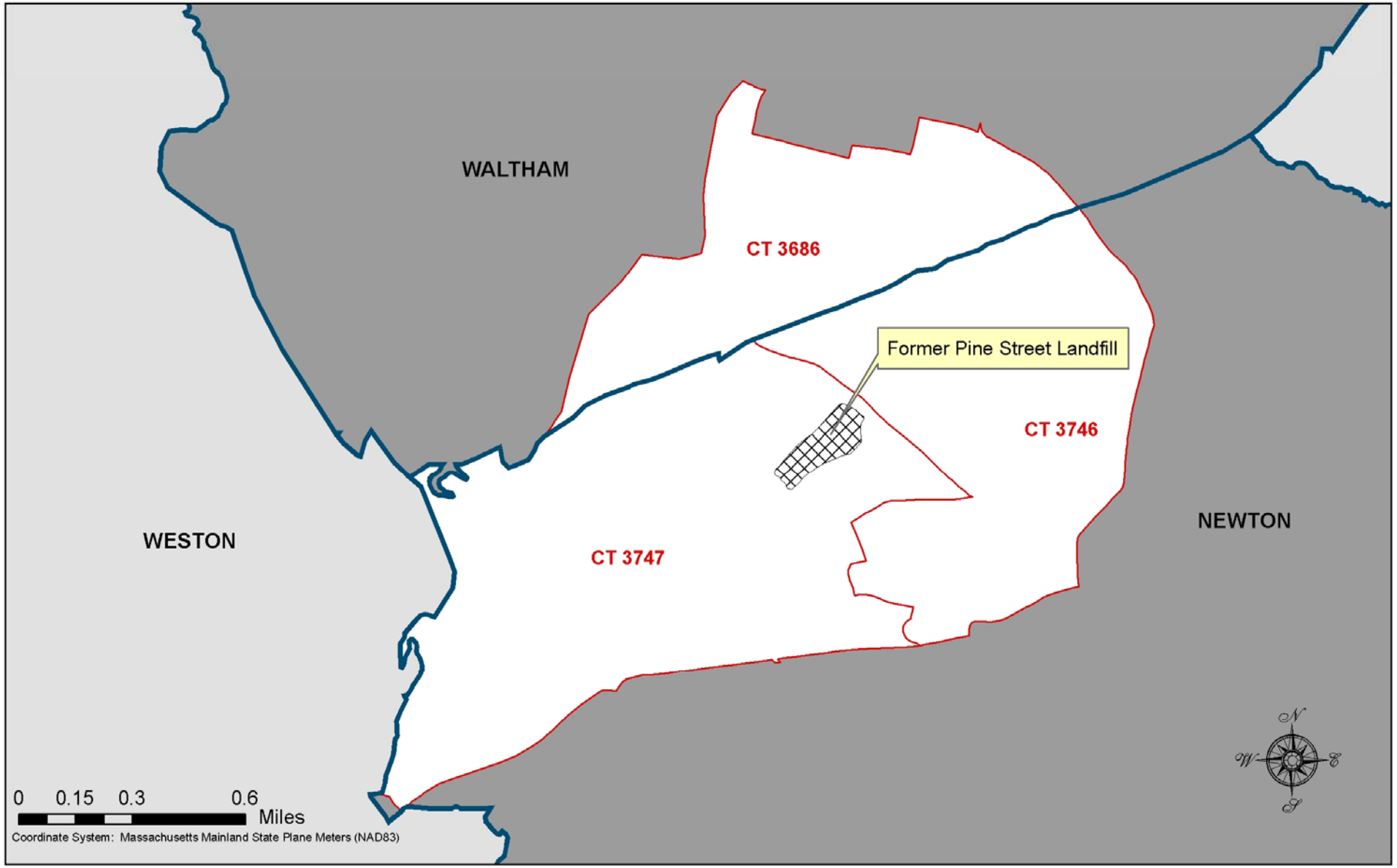
Figures

Figure 1
Newton Census Tracts 3746 & 3747 and Waltham Census Tract 3686



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<PMCW>, <4/15/2009>

Geographic data supplied by: Massachusetts Executive Office of Environmental Affairs, MassGIS; Geographic Data Technology, Inc.

Legend

- Former Pine Street Landfill
- Census Tracts 3746, 3747, & 3686

Tables

TABLE 1
Cancer Incidence
Newton, Massachusetts
CT 3746
2000-2004

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Bladder	4	3.5	NC	NC -- NC	4	2.5	NC	NC -- NC	0	1.0	NC	NC -- NC
Brain and CNS	2	1.9	NC	NC -- NC	1	1.0	NC	NC -- NC	1	0.9	NC	NC -- NC
Breast	19	20.7	92	55 -- 143	0	0.2	NC	NC -- NC	19	20.5	93	56 -- 145
Kidney/Renal Pelvis	3	3.7	NC	NC -- NC	3	2.3	NC	NC -- NC	0	1.5	NC	NC -- NC
Leukemia	4	3.2	NC	NC -- NC	2	1.7	NC	NC -- NC	2	1.4	NC	NC -- NC
Liver/IBD	0	1.5	NC	NC -- NC	0	1.1	NC	NC -- NC	0	0.4	NC	NC -- NC
Lung/Bronchus	14	19.6	71	39 -- 120	8	10.1	79	34 -- 156	6	9.5	63	23 -- 137
Non-Hodgkin Lymphoma	2	5.4	NC	NC -- NC	1	2.8	NC	NC -- NC	1	2.6	NC	NC -- NC
Pancreas	2	3.2	NC	NC -- NC	1	1.5	NC	NC -- NC	1	1.7	NC	NC -- NC
Stomach	1	2.2	NC	NC -- NC	1	1.4	NC	NC -- NC	0	0.8	NC	NC -- NC
Thyroid	0	2.9	NC	NC -- NC	0	0.6	NC	NC -- NC	0	2.3	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 2
Cancer Incidence
Newton, Massachusetts
CT 3747
2000-2004

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Bladder	2	3.0	NC	NC -- NC	1	2.1	NC	NC -- NC	1	0.9	NC	NC -- NC
Brain and CNS	3	1.7	NC	NC -- NC	2	0.9	NC	NC -- NC	1	0.8	NC	NC -- NC
Breast	31	18.3	169	* 115 -- 240	0	0.1	NC	NC -- NC	31	18.2	170	* 116 -- 242
Kidney/Renal Pelvis	4	3.2	NC	NC -- NC	3	1.9	NC	NC -- NC	1	1.3	NC	NC -- NC
Leukemia	1	2.7	NC	NC -- NC	0	1.4	NC	NC -- NC	1	1.3	NC	NC -- NC
Liver/IBD	1	1.3	NC	NC -- NC	1	0.9	NC	NC -- NC	0	0.4	NC	NC -- NC
Lung/Bronchus	14	16.7	84	46 -- 141	7	8.2	85	34 -- 175	7	8.5	83	33 -- 170
Non-Hodgkin Lymphoma	5	4.7	107	35 -- 251	4	2.3	NC	NC -- NC	1	2.3	NC	NC -- NC
Pancreas	3	2.8	NC	NC -- NC	2	1.3	NC	NC -- NC	1	1.5	NC	NC -- NC
Stomach	2	1.9	NC	NC -- NC	0	1.1	NC	NC -- NC	2	0.8	NC	NC -- NC
Thyroid	3	2.6	NC	NC -- NC	0	0.6	NC	NC -- NC	3	2.0	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 3
Cancer Incidence
Census Tract 3686 in Waltham, Massachusetts
2000-2004

Census Tract	Total					Males					Females				
	Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI	
Bladder	0	2.5	NC	NC	NC	0	1.7	NC	NC	NC	0	0.7	NC	NC	NC
Brain & CNS	2	1.7	NC	NC	NC	2	0.9	NC	NC	NC	0	0.8	NC	NC	NC
Breast	9	16.7	54	25	102	0	0.1	NC	NC	NC	9	16.6	54	25	103
Kidney/Renal Pelvis	2	2.9	NC	NC	NC	1	1.8	NC	NC	NC	1	1.1	NC	NC	NC
Leukemia	3	2.5	NC	NC	NC	1	1.4	NC	NC	NC	2	1.1	NC	NC	NC
Liver/IBD	1	1.2	NC	NC	NC	1	0.9	NC	NC	NC	0	0.3	NC	NC	NC
Lung & Bronchus	15	14	107	60	177	6	7.0	86	31	187	9	7.0	128	59	244
Non-Hodgkin's Lymphoma	4	4.3	NC	NC	NC	2	2.3	NC	NC	NC	2	2.0	NC	NC	NC
Pancreas	1	2.3	NC	NC	NC	0	1.1	NC	NC	NC	1	1.2	NC	NC	NC
Stomach	2	1.6	NC	NC	NC	1	1.0	NC	NC	NC	1	0.6	NC	NC	NC
Thyroid	2	3.0	NC	NC	NC	0	0.7	NC	NC	NC	2	2.4	NC	NC	NC

Note: SIRs are calculated based on the exact number of expected cases.
Expected number of cases presented are rounded to the nearest tenth.
SIRs and 95% CI are not calculated when observed number of cases < 5.

Obs = Observed number of cases
Exp = Expected number of cases
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

Appendix A

Key Statistics

Breast cancer is the most frequently diagnosed cancer among women in the United States, except for skin cancers. The American Cancer Society estimates that in 2008, approximately 182,460 women in the U.S. and 4,480 women in Massachusetts will be diagnosed with breast cancer. It is estimated that in 2008, breast cancer will account for approximately 26% of all cancer diagnoses in females. Between 2001 and 2005, breast cancer accounted for 29% of cancer diagnoses in females in Massachusetts.

Breast cancer incidence has been rising in the United States since the 1980s. However, the rate decreased by 3.5% per year between 2001 and 2004. Since 1990 the largest decrease in incidence rates has been observed in females under 50 years of age. A similar trend occurred in Massachusetts and there was even a significant decrease in incidence (2.5%) between 1998 and 2002.

The chance of developing invasive breast cancer at some time in a woman's life is about 1 in 8. Women are 100 times more likely than men to develop this disease and risk increases with age. Men can also develop breast cancer, but male breast cancer is rare, accounting for less than 1% of all breast cancer cases. For more information on breast cancer in men, visit the American Cancer Society website at www.cancer.org.

A woman’s risk of developing breast cancer increases with age. About 1 out of 8 invasive breast cancers are found in women younger than 45, while about 2 out of 3 invasive breast cancers are found in women age 55 or older. White women are slightly more likely to develop breast cancer than women of other races and ethnicities.

Types of Breast Cancer

The term "cancer" is used to describe a variety of diseases associated with abnormal cell and tissue growth. Cancers are classified by the location in the body where the disease originated (the primary site) and the tissue or cell type of the cancer (histology).

There are several types of breast cancer, although some of them are quite rare. In some cases a single breast tumor can have a combination of these types or have a mixture of invasive and *in situ* cancer.

In situ breast cancers are considered the earliest stage of cancer, when it is confined to the layer of cells where it began. They have not invaded into deeper tissues in the breast or spread to other organs in the body, and are sometimes referred to as non-invasive breast cancers. This risk factor summary discusses and pertains to invasive breast cancers.

Additional information on *in situ* breast cancers and other benign breast conditions can be found at www.cancer.org (American Cancer Society).

An invasive, or infiltrating, cancer is one that has already grown beyond the layer of cells where it started (as opposed to carcinoma *in situ*). Most breast cancers are invasive carcinomas -- either invasive ductal carcinoma or invasive lobular carcinoma.

Invasive ductal carcinoma (IDC) is the most common type of breast cancer and accounts for 75%–80% of all breast cancers. IDCs begin in the cells lining the milk duct of the breast, break through the wall of the duct, and grow into the fatty tissue of the breast. At this point, it may be able to spread (metastasize) to other parts of the body through the lymphatic system and bloodstream.

Invasive lobular carcinoma (ILC) starts in the milk-producing glands (lobules) and account for approximately 10% of invasive breast cancers. Like IDC, it can metastasize to other parts of the body. Invasive lobular carcinoma may be harder to detect by a mammogram than invasive ductal carcinoma.

Other less common types of invasive breast cancer include:

- inflammatory breast cancer
- triple-negative breast cancer
- medullary carcinoma
- metaplastic carcinoma
- mucinous carcinoma
- Paget's disease
- tubular carcinoma
- papillary carcinoma
- adenoid cystic carcinoma or adenocystic carcinoma
- Phyllodes tumor
- angiosarcoma

Known Risk Factors

A risk factor is anything that increases a person's chance of developing cancer. Some risk factors can be controlled while others cannot. Although risk factors can influence the development of cancer, most do not directly cause cancer. Knowing the risk factors that apply to you and discussing them with your doctor can help to make more informed lifestyle and health-care decisions. A woman's risk for developing breast cancer can change over time due to many factors and it is likely that multiple risk factors influence the development of breast cancer.

Hereditary Conditions

Having a family history of breast cancer increases a woman's risk of developing the disease. Women who have a first-degree relative (e.g. mother, sister) with breast cancer experience double the risk. Having two first-degree relatives with this disease increases a woman's risk by five-fold. Women with a brother or father who has had breast cancer are also at an increased risk. Overall, about 20-30% of woman with breast cancer have a family member with the same disease. Therefore, 70-80% of women who have breast cancer have no familial link to the disease.

About 5-10% of breast cancer diagnoses are thought to be due to a genetic mutation. Most of these mutations occur in the *BRCA1* and *BRCA2* genes. Other genes that may lead to an increased risk for developing breast cancer include *ATM*, *CHEK2*, *p53* and *PTEN*. Women who inherit these gene mutations have up to an 80% chance of developing breast cancer during their lifetime.

Medical Conditions and Treatments

Certain benign breast conditions may increase one's risk for breast cancer. Proliferative lesions without atypia, which have excessive growth of cells in the ducts or lobules of breast tissue, slightly raise a female's risk by 1.5 to 2 times. Proliferative lesions with atypia, when the cells are excessively growing and no longer appear normal, raise one's risk by 4 to 5 times. Women with denser breast tissue (as seen on a mammogram) have more glandular tissue and less fatty tissue, and have a higher risk of breast cancer.

A woman with cancer in one breast is 3 to 4 times more likely to develop a new cancer in the other breast or in another part of the same breast. In addition, a previous diagnosis of an *in situ* breast cancer puts a woman at increased risk for an invasive breast cancer.

Cumulative exposure of the breast tissue to estrogen is associated with breast cancer risk. Several factors can influence estrogen levels. Women who started menstruating at an early age (before age 12) and/or went through menopause at a later age (after age 55) have a slightly higher risk of breast cancer. Also, women who have had no children or have had their first child when over the age of 30 have an increased risk for developing breast cancer. Women who have had more children and those who have breast-fed seem to be at decreased risk.

Use of hormone replacement therapy is another factor that affects hormone levels. Long-term use (several years or more) of combined post-menopausal hormone therapy (PHT) increases the risk of breast cancer. The increased risk from combined PHT appears to apply only to current and recent users. A woman's breast cancer risk seems to return to that of the general population within 5 years of stopping combined PHT. The use of estrogen-

only replacement therapy (ERT) does not appear to increase the risk of breast cancer significantly but when used long term (for more than 10 years), ERT has been found to increase the risk of ovarian and breast cancer in some studies.

Women who had radiation therapy to the chest area as treatment for another cancer are at significantly increased risk for breast cancer. This risk appears to be highest if the radiation is given during adolescence or puberty, when the individual's breasts are developing.

From the 1940s through the 1960s some pregnant women were given the drug diethylstilbestrol (DES) because it was thought to lower their chances of miscarriage. These women have a slightly increased risk of developing breast cancer. A woman whose mother took DES while pregnant may also have a slightly higher risk of breast cancer.

Lifestyle Factors

Alcohol consumption has also been associated with increased risk for breast cancer. Women who consumed one alcoholic beverage per day experienced a slight increase in risk (approximately 10%) compared to non-drinkers, however those who consumed 2 to 5 drinks per day experienced a 1.5 times increased risk.

Possible Risk Factors

Medical Conditions

Like breast cancer, ovarian cancer is associated with exposure to hormones and gene mutations such as *BRCA1* and *BRCA2*. Because of this, a history of ovarian cancer can increase a woman's risk of breast cancer.

Lifestyle Factors

Recent studies have indicated that being overweight or obese may put a woman at increased risk of breast cancer, especially after menopause. Similarly, women who are physically inactive throughout life may have an increased risk of breast cancer. Being active may help reduce risk by preventing weight gain and obesity.

Studies have found that women using oral contraceptives (birth control pills) have a slightly greater risk of breast cancer than women who have never used them, but this risk seems to decline once their use is stopped. Women who stopped using oral contraceptives more than 10 years ago do not appear to have any increased breast cancer risk. When thinking about using oral contraceptives, women should discuss their other risk factors for breast cancer with their physician.

Lifetime risk of breast cancer is increased in women of higher SES. This may be due to differing reproductive patterns and lifestyle factors (age at first full-term birth, physical activity, cultural practices, etc.).

Weak or Unknown Risk Factors

Medical Conditions and Treatments

Large, well-designed studies have shown no link between miscarriage or abortion and breast cancer.

Environmental Exposures

A great deal of research has been reported and more is being done to understand possible environmental influences on breast cancer risk. Of special interest are compounds in the environment that have been found in lab studies to have estrogen-like properties, which could in theory affect breast cancer risk. For example, substances found in some plastics, certain cosmetics and personal care products, pesticides (such as DDE), and PCBs (polychlorinated biphenyls) seem to have such properties. While this issue understandably invokes a great deal of public concern, at this time research does not show a clear link between breast cancer risk and exposure to these substances.

Lifestyle Factors

Though links have been suggested, antiperspirants, bras, and breast implants have all been investigated as possible risk factors for breast cancer but no associations have been found.

The role of cigarette smoking in the development of breast cancer is unclear. Overall, data do not provide strong evidence for an association between active cigarette smoking and breast cancer risk. Some studies suggest a relationship between passive smoking and

increased risk for breast cancer; however, confirming this relationship has been difficult due to the lack of consistent results from studies investigating first-hand smoke exposure.

Dietary fat intake is another factor that has been suggested to increase a woman's risk for breast cancer. Though studies have found decreased breast cancer rates in countries with a diet typically lower in fat, studies in the U.S. have not shown an association between the amount of fat in the diet and increased risk of breast cancer.

Several recent studies have suggested working at night as a risk factor for women developing breast cancer. The effect may be due to a disruption of melatonin, a hormone whose production is affected by the body's exposure to light, but more studies are needed.

References/For More Information

Much of the information contained in this summary has been taken directly from the following sources. This material is provided for informational purposes only and should not be considered as medical advice. Persons with questions regarding a specific medical problem or condition should consult their physician.

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